

# Fiber, Whole Grains, High Glycemic Index and Obesity, Insulin

Dietary predictors of **obesity and insulin resistance** include reduced intake of **fiber and whole grains**, and **high glycemic index**.

## General Information

<b>Broad Focus Area</b>	Obesity and altered physical development
<b>Background and Justification</b>	The glycemic index of foods reflects the increase in blood sugar that occurs after eating; whole grain and high fiber foods tend to have a low glycemic index. Animal and adult human data suggest that a diet rich in foods with a low glycemic index prevents obesity. Furthermore, consumption of foods with a high glycemic index has been associated with increased risk of type 2 diabetes in some epidemiologic studies of adults, but not all. <sup>1</sup> The data for humans, while sparse, <sup>1</sup> are nonetheless sufficient, when considered with the supporting mechanistic evidence, <sup>2</sup> to support the need for randomized trials to evaluate efficacy of diets with low glycemic indexes for prevention of obesity in adults. <sup>3</sup> Meals with a high glycemic index were found to induce metabolic responses that promote food intake in teenage boys, suggesting that further work on glycemic index and obesity in children is needed. <sup>4</sup> Given the paucity of human data, and the relation between childhood and adult obesity, further data on this aspect of diet in relation to childhood overweight is needed. If the NCS identifies attributes of diet that are associated with prevention of overweight in children, this could have a substantial impact on dietary recommendations.
<b>Prevalence/ Incidence</b>	The prevalence of overweight among children is greater than 16% among children aged 6 years or more, and this prevalence has increased over the past 40 years. <sup>5,6</sup> Being overweight as a child is a risk factor for being overweight in adulthood, <sup>7</sup> and is associated with increased risk of type 2 diabetes, hypertension, and coronary artery disease. <sup>8</sup> Furthermore, being overweight as a child increases the risk of developing type 2 diabetes before the age of 21 years. <sup>9</sup>
<b>Economic Impact</b>	Because child overweight is a risk factor for adult overweight, child overweight contributes to the more than \$40 billion annual cost of obesity in the U.S. <sup>10</sup>

Exposure Measures		Outcome Measures	
<b>Primary/Child</b>	Diet & nutrition measures; [intake by diary, questionnaire or recall.]	<b>Primary/Child</b>	<u>Insulin resistance:</u> - Serum insulin levels, Glucose levels, HgbA1C <u>Obesity:</u> - IGF - Body size and habitus - Body composition
Methods	Interview; Food intake diary	Methods	Blood sample, Physical exam anthropometry, body composition
Life Stage	Periodically	Life Stage	Periodically

## Important Confounders/Covariates

Lipid profile	Increased lipid levels are associated with an increased risk of insulin resistance <sup>14</sup>
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Glucokinase mutation	Glucokinase mutation is associated with increased risk of maturity onset diabetes of the young (MODY) <sup>15</sup>
Hormone levels such as cortisol, growth hormone, insulin-like growth factors	Elevated levels of these and other hormones are associated with obesity and insulin resistance in children <sup>16</sup>
Genetic markers for obesity	Certain genetic markers increase risk of obesity
Parents' body mass indices	BMI and obesity are associated with certain genetic markers. <sup>17</sup>
Family history of diabetes and obesity	A family history of diabetes and obesity increases child's risk. <sup>18, 17</sup>
Lifestyle factors	Less active lifestyles would increase risk of obesity and insulin resistance. <sup>9</sup>
Nutrition	Poor nutritional and high caloric diet would increase risk of obesity and insulin resistance <sup>19</sup>
Socio-economic status and demographics	Children of lower economic status, ethnic and racial groups (particularly Native Americans, Hispanics, African Americans, and Asians) are at higher risk of obesity and insulin resistance. <sup>18</sup>

Population of Interest		Estimated Effect that is Detectable
All children.		

Other Design Issues	
<b>Ethical/Burden Considerations</b>	Blood studies, especially fasting, in younger children will require careful attention. Obtaining consent for the use of DNA may be an issue.
<b>Cost/Complexity of Data Collection</b>	Addressing this hypothesis based on obesity and insulin resistance measures at later life-stages may be adversely impacted by attrition of study subjects.

### References:

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<sup>18</sup> Fact Sheet: SEARCH for Diabetes in Youth. CDC: Department of Health and Human Services  
<http://www.cdc.gov/diabetes/pubs/factsheets/search.htm>

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